

AMORPHOUS CARBON NITRIDE FOR USE AS A HIGH TEMPERATURE CAPACITOR DIELECTRIC

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Abstract

Amorphous carbon nitride (CN_x) thin film is being investigated for use as a high temperature dielectric for high energy density, high pulse power capacitors. It is anticipated that CN_x will display properties of high thermal conductivity, thermal stability, electrical resistance, and electrical breakdown strength. However, CN_x films containing high concentrations of hydrogen exhibit poor electrical and thermal characteristics. Initial deposition techniques resulted in CN_x films with hydrogen concentrations as high as 40 at.%. Through control of the vacuum environment and deposition parameters of a dual ion-beam assisted, ion-beam sputter deposition system, CN_x films are created with hydrogen concentrations averaging less than 5 at.%. Elemental analysis using Rutherford-Backscattering Spectroscopy (RBS) and Elastic Recoil Spectroscopy (ERS) on CN_x samples annealed in 99.999% argon shows that the resulting films are thermally stable up to 500°C. Capacitance measurements performed on CN_x films low in hydrogen concentration reveal resistivities up to $1 \times 10^{13} \Omega\text{-cm}$.